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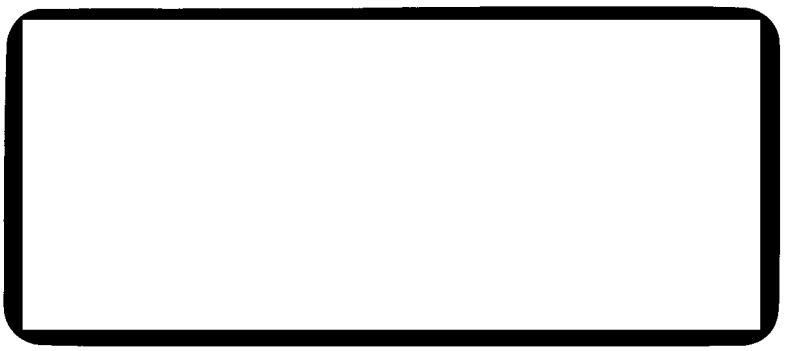

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Water Survey of Canada: Application For Use of ERTS-A For Retransmission of Water Resources Data

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Type II Report for Period July - December, 1972

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14. Supplementary Notes

15. Abstract

Nine sites in isolated regions in Canada have been selected for installation of ERTS Data Collection Platforms. Seven platforms were installed in 1972, one of which did not operate. The six operating platforms transmitted over 7000 water level readings from stream gauging stations. This data is available on a near real time basis through the Canada Center for Remote Sensing and is used for river flow forecasting. The practicability of using satellite retransmission as a means of obtaining data from remote areas has been demonstrated.

PREFACE

The purpose of the investigation is to use ERTS DCPs to collect a discreet water level reading once daily from each of nine gauging stations and to use this data for operational purposes. In this manner the dependability, costs, and other aspects of the whole system will be studied and decisions made with respect to the feasibility and advantages of establishing a much larger network of Data Collection Platforms dependent on future satellite facilities.

Nine sites have been selected and DCPs installed at seven of these sites. In order to make full use of the 64 bit capacity of the DCPs, consideration is being given to transmitting additional parameters that would be of value for flow forecasting purposes.

To the end of 1972 approximately 7000 transmissions were received from six operating DCPs. The number of transmissions per day varied from 3 to 26 per day depending on the site. Of the 7000 transmissions received, only 2 were found to be incorrect. Quality checks of data that appear to be correct indicate that the data are, in fact, correct. This has been verified often enough that we do not plan to make any more intensive quality checks.

On the basis of our experience to date, it can be concluded that water resources data can be transmitted reliably and at reasonable cost by satellite. The concept of an operational satellite retransmission system appears to be very attractive.

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The Water Survey of Canada operates over 2400 gauging stations at which water level data are collected. At most stations the water level data are used to compute river discharge data. This data may be used for design of structures and works, flow and flood forecasting, project regulation and for pollution control. In many instances it would be desirable to obtain data on a near real time basis; however, because of the isolated locations of most gauging stations, the cost of doing this has been prohibitive.

Therefore, when the ERTS Data Collection System was proposed it seemed worthwhile to investigate the possibility of using a satellite retransmission system to collect a discreet water level reading once daily from a few gauging stations and to use this data for operational purposes. In this way the dependability, costs, and other aspects of the whole system could be studied and decisions made with respect to the feasibility and advantages of establishing a much larger network of Data Collection Platforms dependent on future satellite facilities.

Nine sites were selected for an experiment with data relay by ERTS spacecraft. These are the Illecillewaet River at Greely, Duncan River below B.B. Creek, and Kootenay River at Fort Steele in south eastern British Columbia, the Mackenzie River at Fort Simpson and at Norman Wells in the western Arctic, Lake Athabasca at Crackingstone Point in northern Saskatchewan, the Kazan River at Outlet of Ennadai Lake in the eastern Arctic, the Winisk River below Asheweig River Tributary and the Albany River above Nottick Island in northern Ontario. The sites were selected on the basis that real time data would be very valuable for flow forecasting purposes and that the severe climatic conditions at the sites would provide a good test of the data collection platform's performance.

Water level at Water Survey of Canada gauging stations is sensed by a float and pulley or by a pressure sensing manometer that senses the static pressure in a nitrogen purge system. The water level is usually recorded on a strip chart recorder. At those stations where ERTS DCPs are installed an analogue to digital shaft encoder is connected to the water level sensor. This encoder (the Leupold & Stevens Memomark II) stores 16 bits of data (4 BCD digits) and is connected directly to the parallel digital plug on the DCP.

As many of the DCPs were installed in areas where temperatures of -60°F can occur, some of the shelters housing the DCPs and sensors were heated using a catalytic propane heater equipped with a 600 Btu orifice. Prior to installation of the heater, an insulated compartment is constructed around the DCP and sensor. Two DCPs that will be exposed to severe temperatures were left unheated so that a performance comparison could be made.

In the period from September 6 to October 31, 1972, seven DCPs plus one DCP antenna were installed. All DCPs were checked out in Ottawa by installing them temporarily prior to shipment to the remote site. One DCP failed this test; however, its antenna was installed in order to permit installation of the DCP during the winter. The locations of the ERTS DCPs is shown in Table One.

One DCP did not transmit from the time of installation. This failure was eventually traced to a loose wire on the antenna. Another DCP that ceased to transmit good data after 24 hours was found to be all right. The problem was in the encoder operation. No failures have occured once a DCP has started transmitting. Some DCPs have been exposed to temperatures of about -40°F and the DCP antennas have survived wind speeds greater than 50 mph and snow loads to a depth of two feet (uncompacted).

In 1972, 7096 DCP messages were received in card form. A computer programme was prepared which translated the octal data into engineering

TABLE ONE

DATA COLLECTION PLATFORMS AT WATER SURVEY OF CANADA STATIONS

Station Name	I.D.	Latitude	Longitude
Duncan River below B.B. Creek	6126	50° 38'	117° 03'
Nahatlatch River below Tachewana Creek	6232	49° 57'	121° 52'
Illecillewaet River at Greeley	6354	51° 01'	118° 05'
Mackenzie River at Fort Simpson	6260	61° 52'	121° 21'
Mackenzie River at Norman Wells	6366	65° 17'	126° 51'
Lake Athabasca at Crackingstone Point	6150	59° 23'	108° 53'
Kazan River at Outlet of Ennadai Lake	6353	61° 15'	100° 58'
Albany River above Nottick Island	6102	51° 38'	86° 24'
Winisk River below Asheweig River	6137	54° 31'	87° 14'
Rideau River at Ottawa [1]	6210	45° 23'	75° 42'

Notes:

1 Operated by Dr. J. Kruus, NDPF-ID F461

units and printed the water level and transmit time along with quality data. For the six stations operating in 1972, the maximum transmissions per day varied from 26 to 12 and the minimum from 10 to 3, depending on the station. The transmission rate was noticeably less for two stations in British Columbia that are in mountainous areas and are surrounded by tall trees. A summary of the transmissions is shown in Table Two. The daily mean transmissions per cycle are consistant for all stations with the exception of cycle 8. The transmission rate for this cycle is lower for all six stations.

All transmissions were scanned for quality and in addition, some data were plotted manually on the analogue recorder chart. Two obviously incorrect readings were noticed. One had the incorrect date and the other had an invalid octal digit. All data that were plotted agreed perfectly with the analog record. Originally we planned to prepare a computer programme to compare the DCP data to that obtained by the analogue recorder but the quality checks indicated that this was not required.

Since our ultimate aim was to use the DCP data for flow forecasting, the 10 to 20 day delay in receiving computer cards was not satisfactory. Arrangements were made for all Canadian DCP data to be received on a real time basis at the Canada Center for Remote Sensing at Ottawa by teletype. The data is then converted to engineering units and stored so that it can be accessed by teletype. In this way the data are made available to users by teletype with no greater than a 12 hour delay. The Canada Center for Remote Sensing will update their files very frequently if required by users during certain critical times.

Plans for the immediate future are to make use of the full capacity of the DCP by transmitting other parameters that could be used for flow forecasting. Also, it has been decided not to install a DCP on the Kootenay River. Instead the DCP will be installed on the Nahatlatch River below Tachewana Creek. This stream is a tributary to the Fraser River and data from this almost inaccessible site

TABLE TWO

SUMMARY OF RETRANSMITTED DATA

Platform I.D.	Daily Mean Transmissions Per Cycle for Cycles 3 to 9							1972 Transmissions		
								Daily		Total
	3	4	5	6	7	8	9	Maximum	Minimum	
6126	-	-	-	8[1]	8	7	8	12	4	518
6232	-	-	-	-	-	-	-	-	-	-
6354	8[1]	9	10	9	10	8	9	16	6	1070
6260	-	-	-	9[1]	11	9	11	16	5	601
6366	-	-	20[1,2]	18[1,2]/10[1]	10	7	9	25[2]/13	3	966
6150	-	31[1,2]	18	18	19	13	17	40[2]/24	10	1974
6353	-	18[1]	18	17	18	13	19	26	7	1967
6102	-	-	-	-	-	-	-	-	-	-
6137	-	-	-	-	-	-	-	-	-	-
								1972 Total		7096

Notes:

1. Incomplete cycle
2. DCP set to 90 second transmission rate

would be very valuable for flood forecasting on the Fraser River.

On the basis of our results so far, it is apparent that satellite retransmission is an excellent method of obtaining data from isolated areas. In fact, in many parts of Canada, it is the only way to obtain data on a real time basis. Capital costs of the equipment installed at a gauging station are reasonable and indications are that the DCPs do not require much maintenance. It would be necessary to continue operating the DCPs for a longer period of time before coming to more definite conclusions.